Abdominal Pain:
acute and chronic

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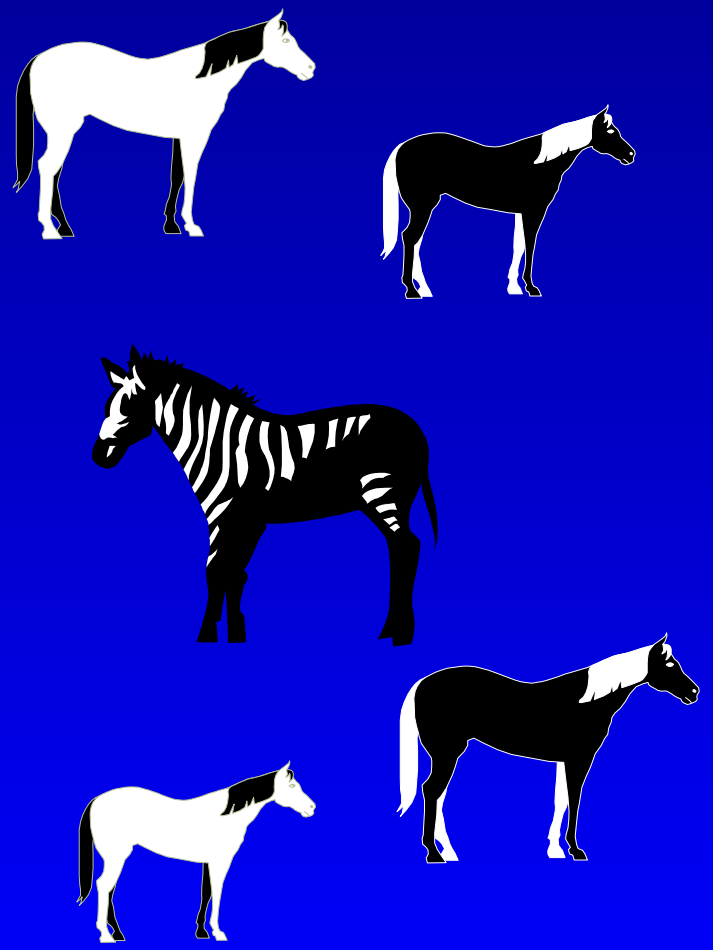
Objectives

- Discuss the mechanisms of abdominal pain
- Review laboratory and radiographic tools
- Review the common and uncommon causes of acute and chronic abdominal pain
- Review functional abdominal disorders



Neuroanatomy

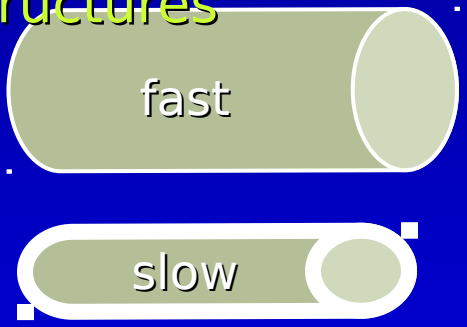
- Visceral organs, peritoneum and greater omentum are insensitive to cutting / tearing / crushing / burning stimuli
  - Noxious stimuli produce pain via:
    - rapid stretching or tension
    - strong forced muscular contraction or spasm
    - distension against resistance
    - traction from neoplasm
    - direct neural invasion by tumor cells
    - inflammation and/or tissue edema
    - ischemia

How we feel pain

mechanical

- receptors within walls, supporting structures

thermal



A-delta fiber - fast = sharp, exquisite, localized pain

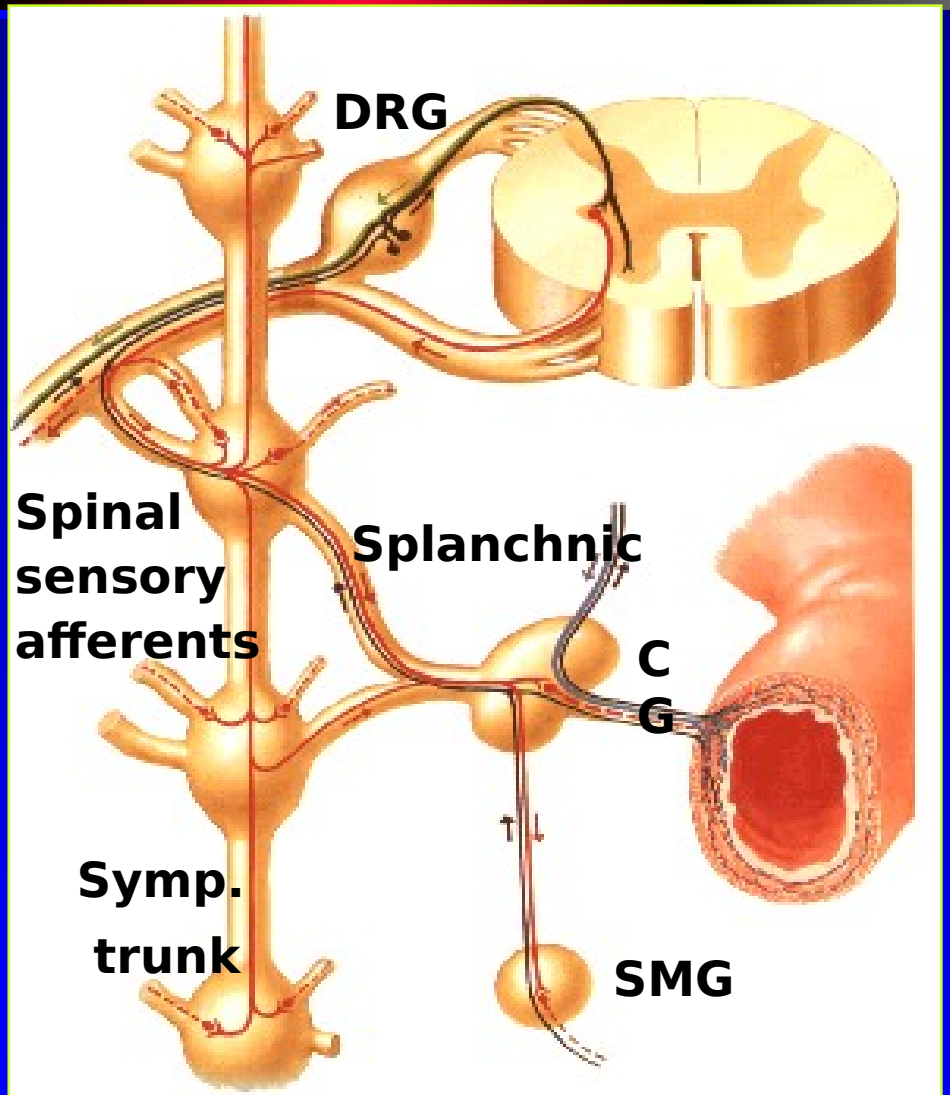
- distributed predominately to skin/muscle

C fiber - slow fibers = dull, crampy, insidious pain

chemical

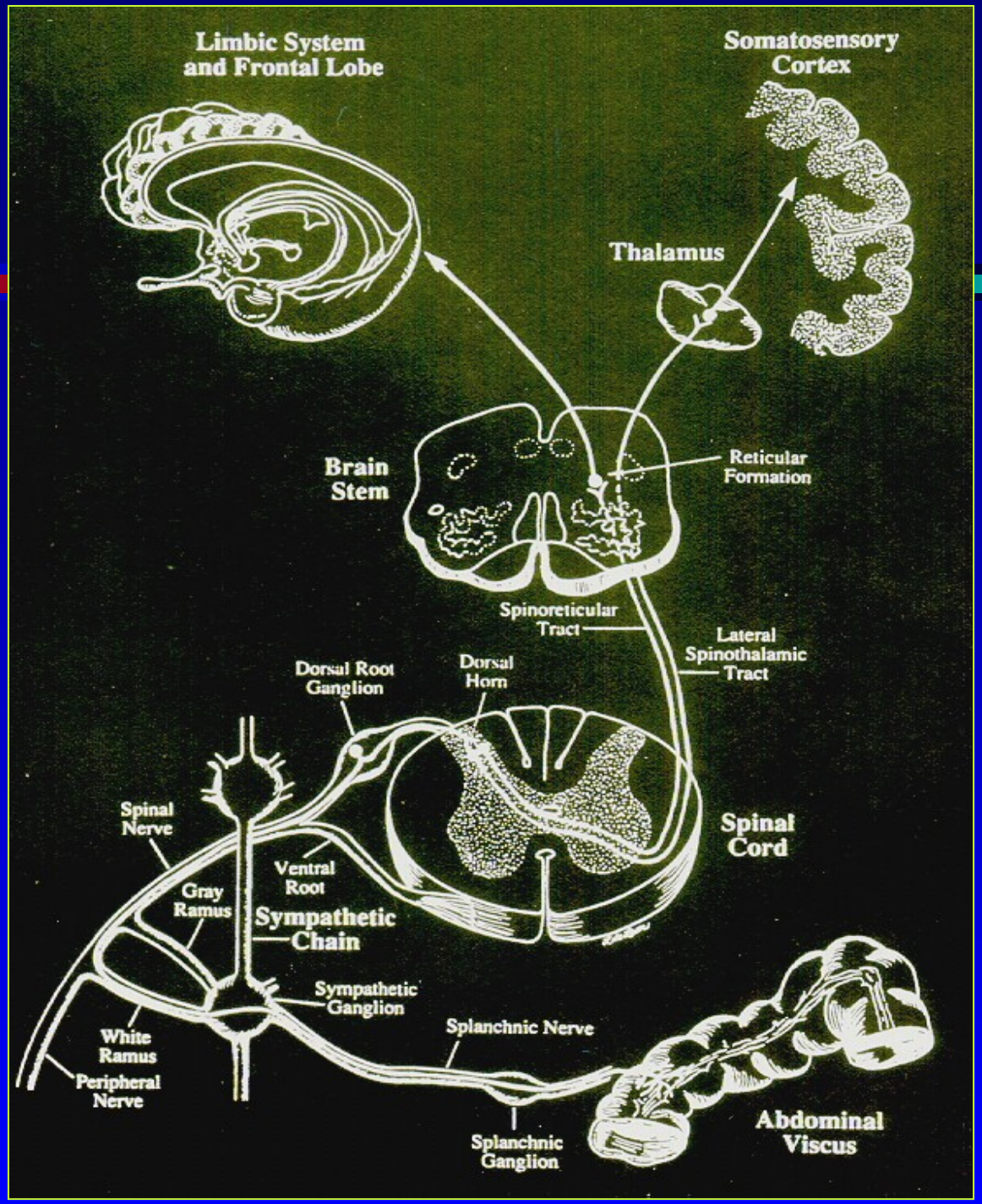
- receptors predominately within mucosa
- responsive to chemical, pH, osmotic changes
- tissue hormones/inflammatory mediators (e.g. histamine) stimulate and/or lower threshold for other stimuli

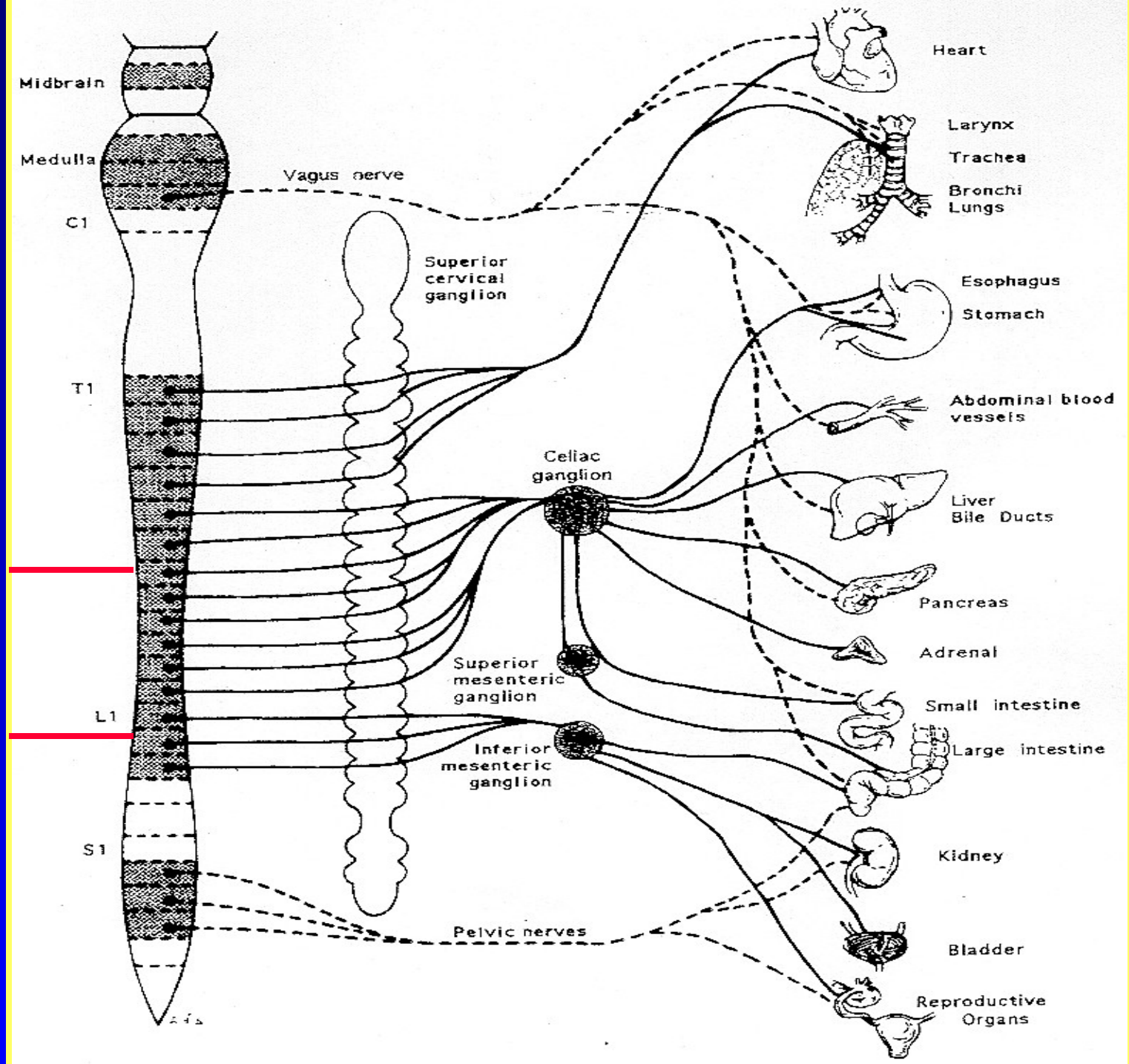
How we feel pain



- Visceral afferent from GI tract via sympathetics to cord
  - appendix, left colon, rectum and pelvic organs via parasympathetic
- Afferent cell bodies lie in DRG of corresponding spinal cord segment
  - dorsal horn cells also receive sensory input from afferents supplying skin/subcut and muscle
    - accounts for referred pain

Abdominal pain

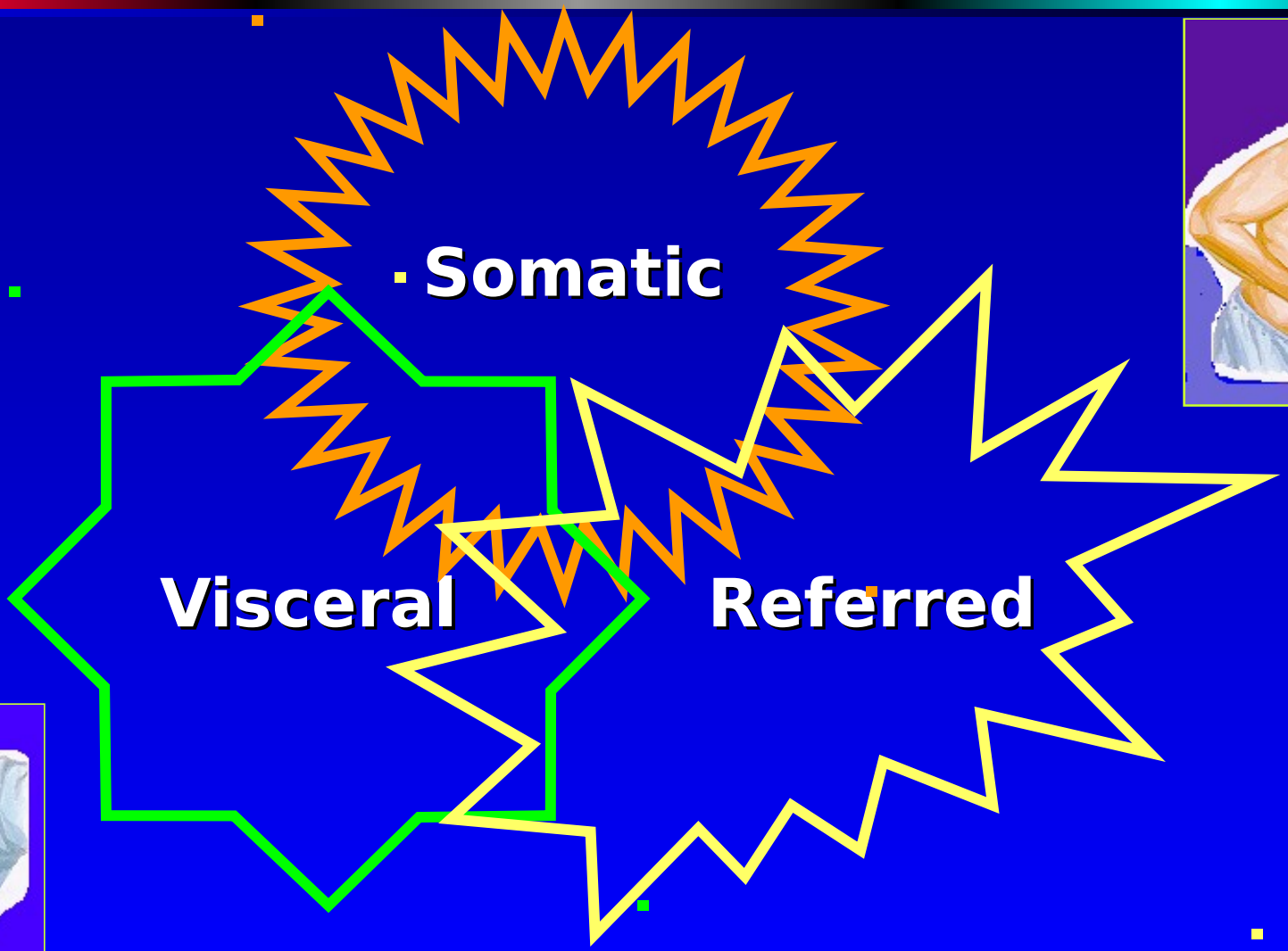



Midbrain
Medulla
C1
T1
L1
S1
Vagus nerve
Superior cervical ganglion
Celiac ganglion
Superior mesenteric ganglion
Inferior mesenteric ganglion
Pelvic nerves
Heart
Larynx
Trachea
Bronchi
Lungs
Esophagus
Stomach
Abdominal blood vessels
Liver
Bile Ducts
Pancreas
Adrenal
Small intestine
Large intestine
Kidney
Bladder
Reproductive Organs

T7

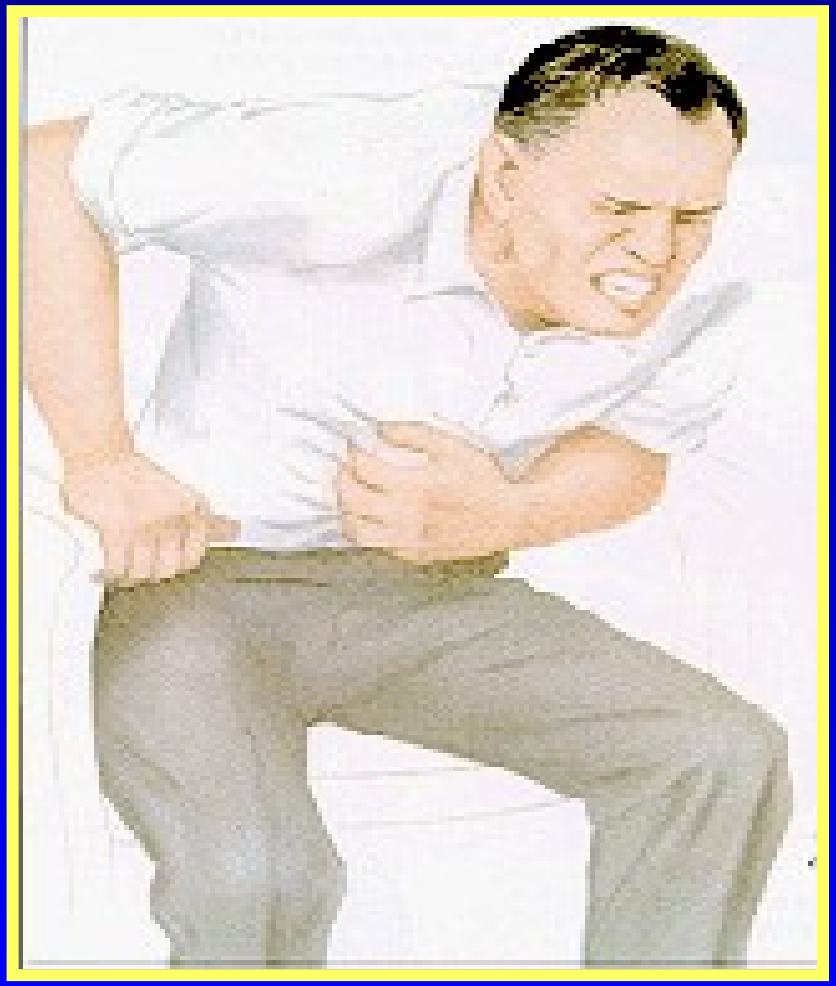
L2

Mechanisms of pain transmission



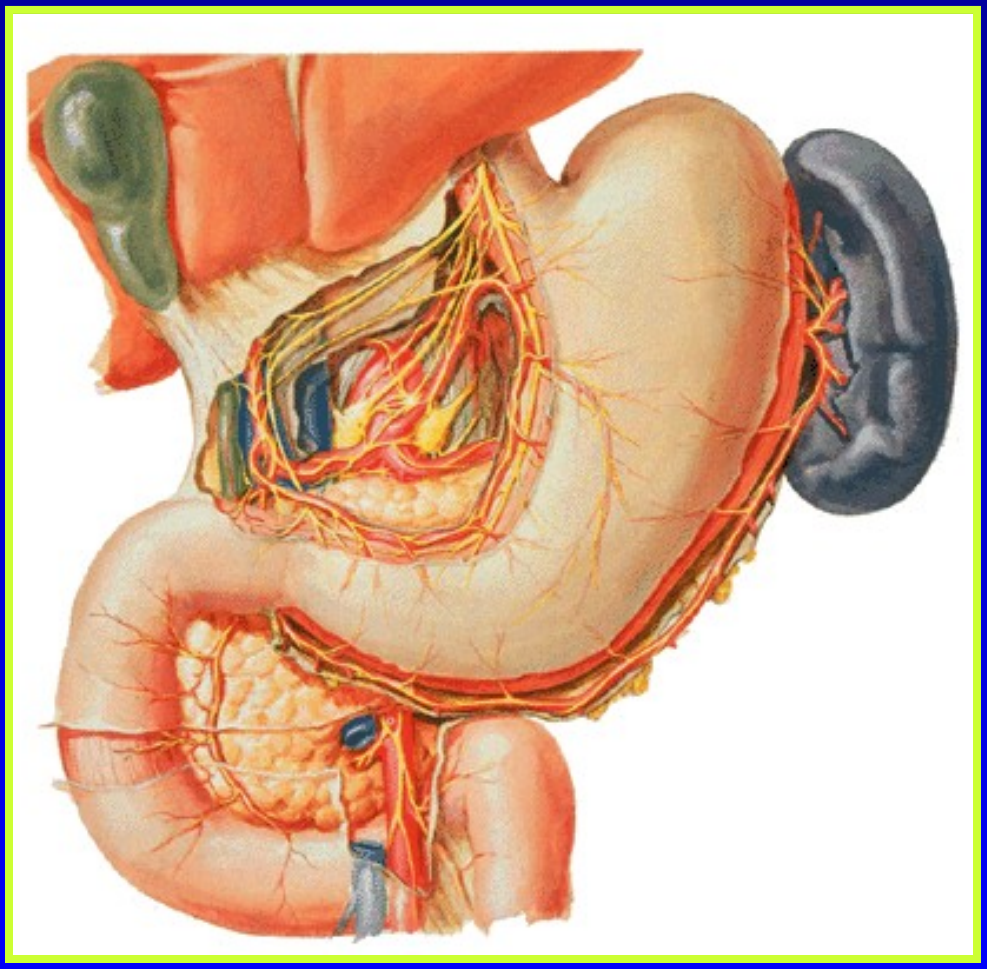
Somatic (parietal) pain

- Stimuli to nociceptors in parietal peritoneum/abdo wall
- Myelinated A-δ afferents
  - specific dorsal root ganglia on same side and at same dermatomal level as origin
  - sharp, discrete, localized
- Aggravated by coughing, moving, sudden jolts
  - patient lies still, scared to move



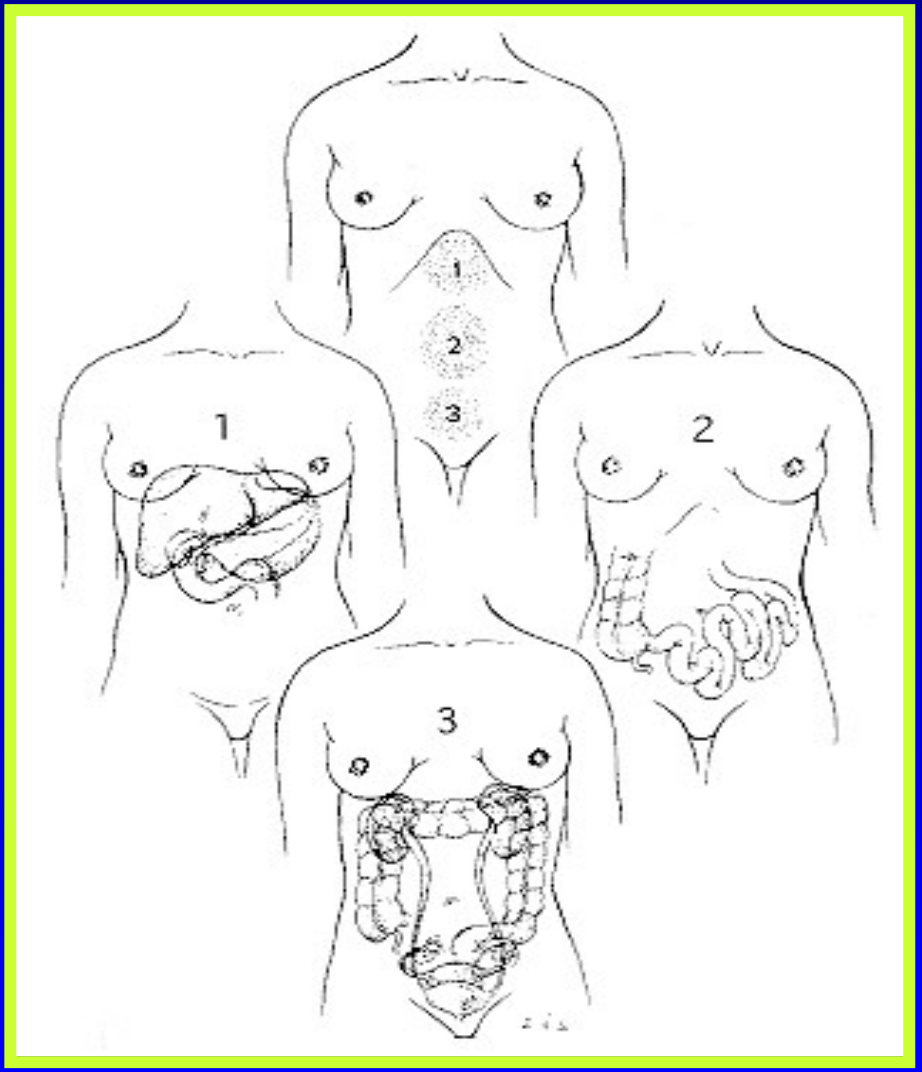
Visceral pain

- Nociceptors in thoracic or abdominal viscera
- Bilateral afferent input
  - enters cord at multiple levels
  - unmyelinated C-fibers



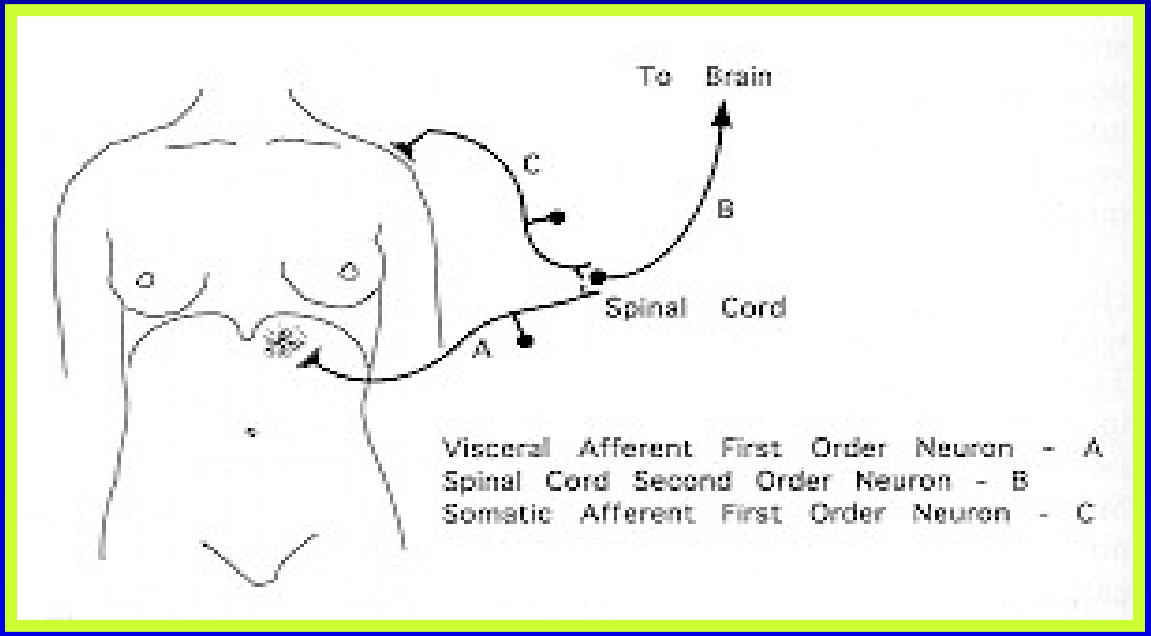
Visceral pain

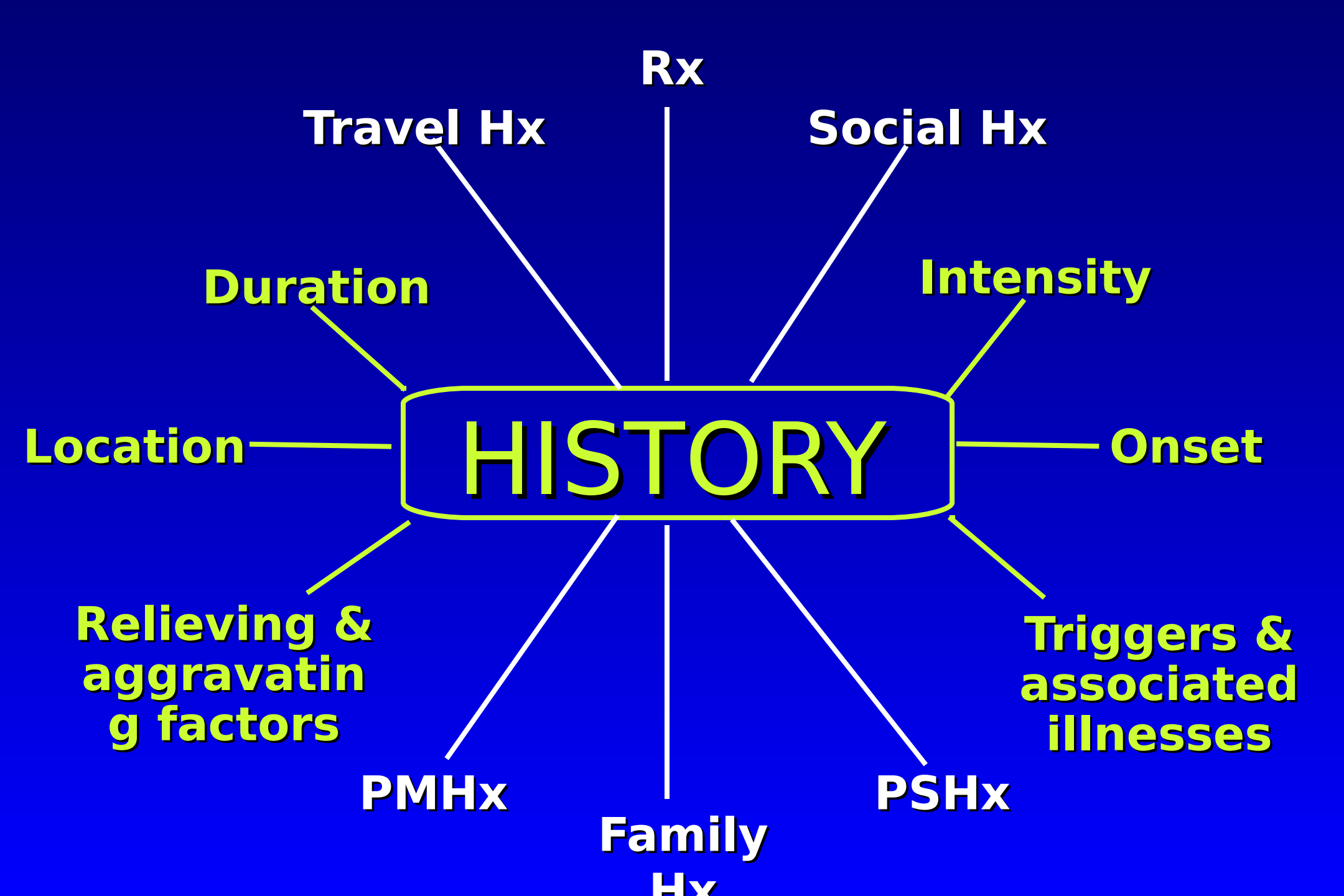
- Dull, achy, crampy, poorly localized, gradual onset, longer duration, midline pain
  - pain from solid organ capsule may lateralize
- Patients are restless, can’t get comfortable
- Autonomic symptoms frequently seen
  - nausea, sweating, pallor



Referred pain

- Poorly localized, dull, aching sensation
- Afferents of cutaneous dermatomes
  - enter cord at same level as the painful abdominal structure
  - e.g. biliary tract visceral nerves enter spinal cord at T5-9




Rx
Travel Hx
Social Hx
Duration
Intensity
HISTORY
Location
Onset
Relieving & aggravatin g factors
Triggers & associated illnesses
PMHx
Family Hx
PSHx

Diagnostic testing

- Laboratory tests
  - insensitive, non-specific for most conditions
    - some conditions require specialized tests e.g porphyria
  - certain patterns may be useful
    - amylase/lipase for pancreatitis
    - transaminases/Alk Phos/Bili for biliary disorders
    - ESR/CRP/CBC may help in inflammatory or AI conditions
  - may help rule out functional disorders
  - ß-HCG mandatory for childbearing women

C-reactive protein

C-Reactive protein for the evaluation of acute abdominal pain. Chi CH et al. *Am J Emergency Medicine* 1996;14(3):254-257

- Evaluate the diagnostic value of CRP in acute abdo pain
- Setting: ER in Taiwan
- 143 patients (67♂, 76♀), mean age 48±20

Variable	Sens.		Spec.		PPV	NPV	Accuracy	p-value
↑WBC* 53%	65%	75%	42%		57%		0.0452	
↑CRP** 79%	64%	79%	64%		73%		<0.0001	
↑CRP&WBC	41%	**89%**	**88%**		44%	58%	0.0001	
↑CRP or WBC	**90%**	35%	73%		36%	71%	0.0006	

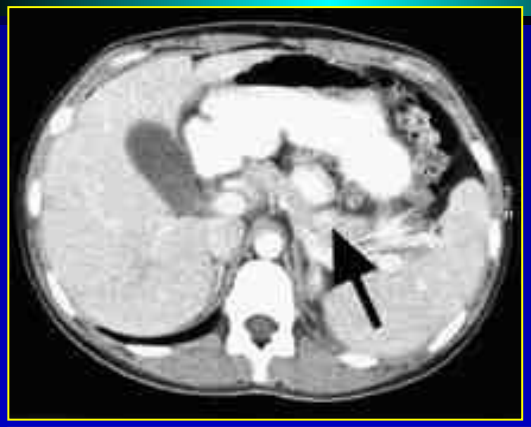
*** >11K**

**** >0.5**

- CRP = surrogate for direct assessment of cytokine generation
  - triggered by inflammation, infection and tissue injury

Diagnostic testing

- Radiology tests
  - plain film (AXR/AAS)
  - barium studies (UGI/SBFT/BE)
  - US
  - CT/MRI
  - nuclear medicine (HIDA)
  - angiography
- Endoscopic studies
  - EUS/EGD/colonoscopy



Utility of plain films

- Initial imaging study for perforation and obstruction
  - Perforation
    - amounts as small as 1-2cc detectable with correct technique
    - sensitivity of 38% for upright film*, 59% for supine film **
  - Obstruction
    - diagnostic in 50-60%, equivocal in 20-30%, normal/nondx or misleading in 10-20% ***
    - overall sensitivity of 66% for SBO

*Stapakis. Diagnosis of pneumoperitoneum: abdominal CT vs. upright chest film. *J Comput Assist Tomogr* 1992;16:713-16

**Levine. Diagnosis of pneumoperitoneum on supine abdominal radiographs. *Am J Roentgenol* 1991;156:731-35

*** Maglinte. The role of radiography in the diagnosis of small-bowel obstruction. *Am J Roentgenol 1997;168:1171-80*

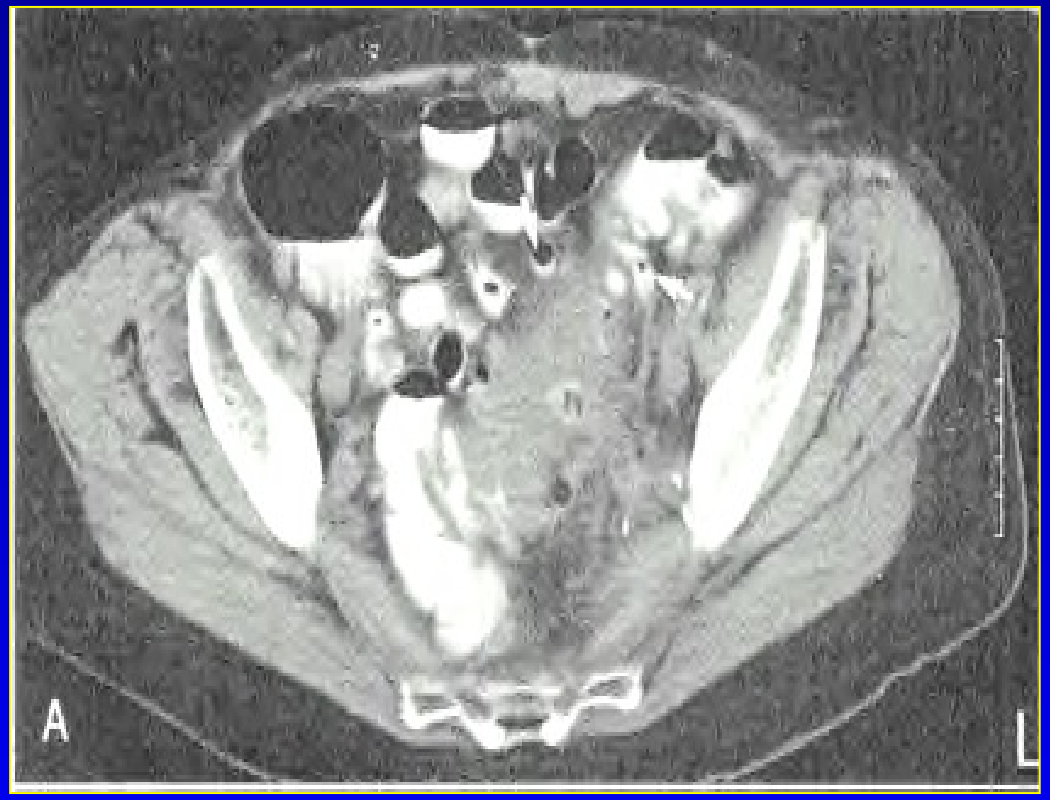
Do plain films add anything ?

Nagurney JT. Plain abdominal radiographs and abdominal CT scans for nontraumatic abdominal pain--added value? *Am J Emergency Medicine* 1999;17:668-672

- Retrospective study (Mass Gen. Hospital), 177 pts had CT scans, 97 (55%) had had preceding AXR
  - complete f/u data available on 74
- Sens/Spec/Accuracy$_{AXR}$: 43,75 and 50%
  - 27 with normal AXR went on to have abnl CT (mainly inflammatory dis/tumors)
  - 24 with abnl AXR went on to have abnl CT (mainly confirmed obstruction)
- Sens/Spec/Accuracy$_{CT}$: 91,94 and 92%

★ "In patients in whom a CT is likely to be ordered anyway, a plain AXR is unhelpful and often misleading"

Computed tomography



- Imaging “workhorse”
  - appendicitis
  - diverticulitis
  - ischemia
  - pancreatitis
  - obstruction
  - perforated viscus
- Helical CT
  - scan while table top moves during single breath-hold
  - reduces respiratory misregistration

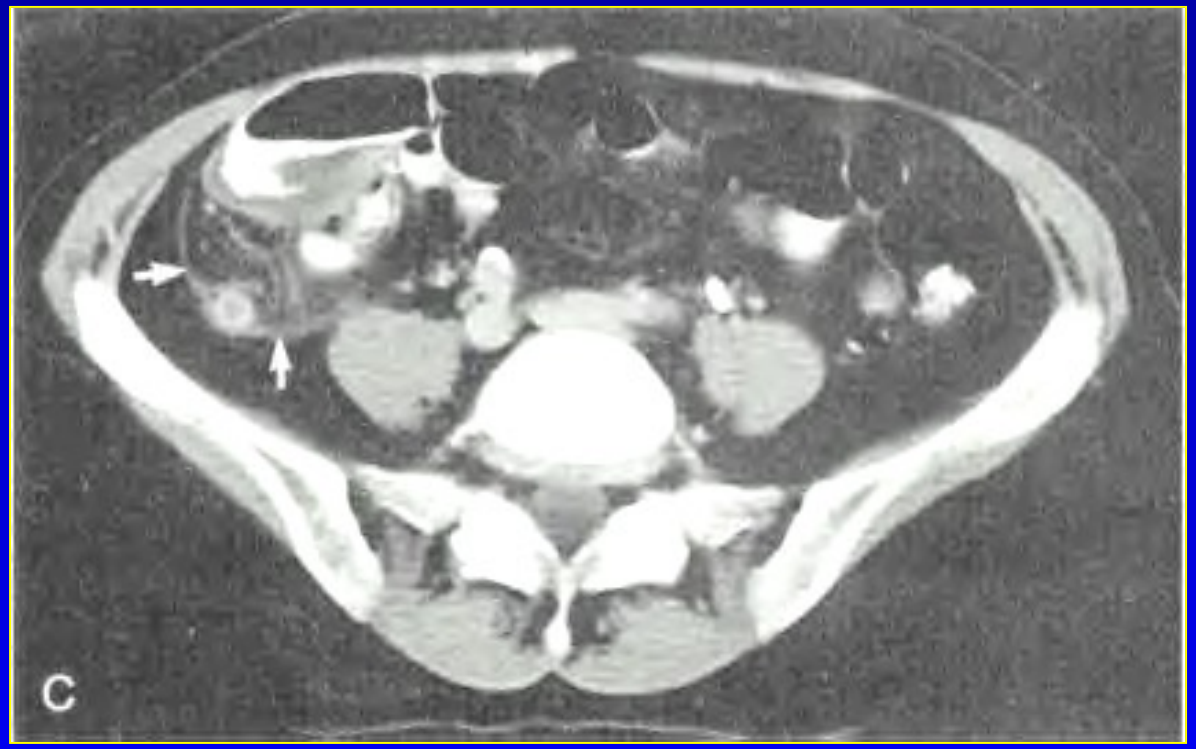
How does IV contrast help

- Vascular abnormalities
  - aneurysms
  - pseudoaneurysms
  - active extravasation
- Solid viscera contrast enhancement
  - infarction
  - abscess
  - intraparenchymal vasc abnl
  - distinguish bile ducts

Table 1. Comparison of the Most Popular CT Imaging Techniques in the Evaluation of the Acute Abdomen

Techniques	Advantages	Disadvantages
IV and oral contrast	Bowel lumen characterized Visualized blood vessels Enhancement patterns Extravasation seen Less need for intrinsic fat contrast	Time consuming Patient cooperation needed Potential contrast reaction Renal function assessment Oral contrast timing Coproliths may be hidden Consent needed Most costly
IV contrast	Visualized blood vessels Extravasation seen Enhancement patterns Less need for intrinsic fat contrast	Potential contrast reaction Renal function assessment Consent needed Costly
Rectal, no IV contrast	Colon/appendix well seen and characterized	Patient cooperation needed Focused examination May be time consuming May be demanding on personnel
No IV, no oral contrast	Rapid No preparation Less patient selection Least costly	Unopacified bowel loops Lack of enhancement decreases specificity Extravasation not seen Needs fat for contrast May be more difficult to learn

CT and US findings in appendicitis



Ultrasound

- Initial study of choice for suspected cholelithiasis and cholecystisis
- Also useful for appendicitis and pelvic pain (endovaginal US)
  - normal appendix compressible and not > 6mm
    - fluid-filled, non-compressible, tender and >6mm with disease
  - Sens/Spec of 85 (range 68-93) and 92 (range 73-100) %

Cholelithiasis and cholecystitis

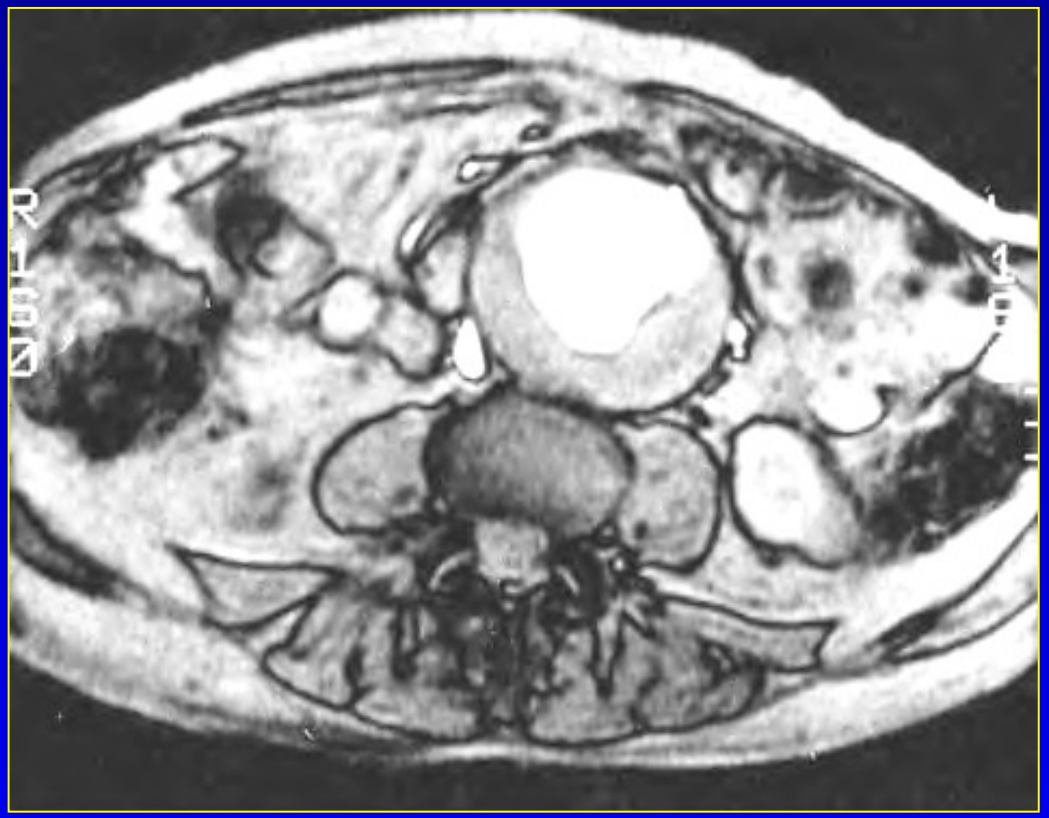
Stones in gall bladder

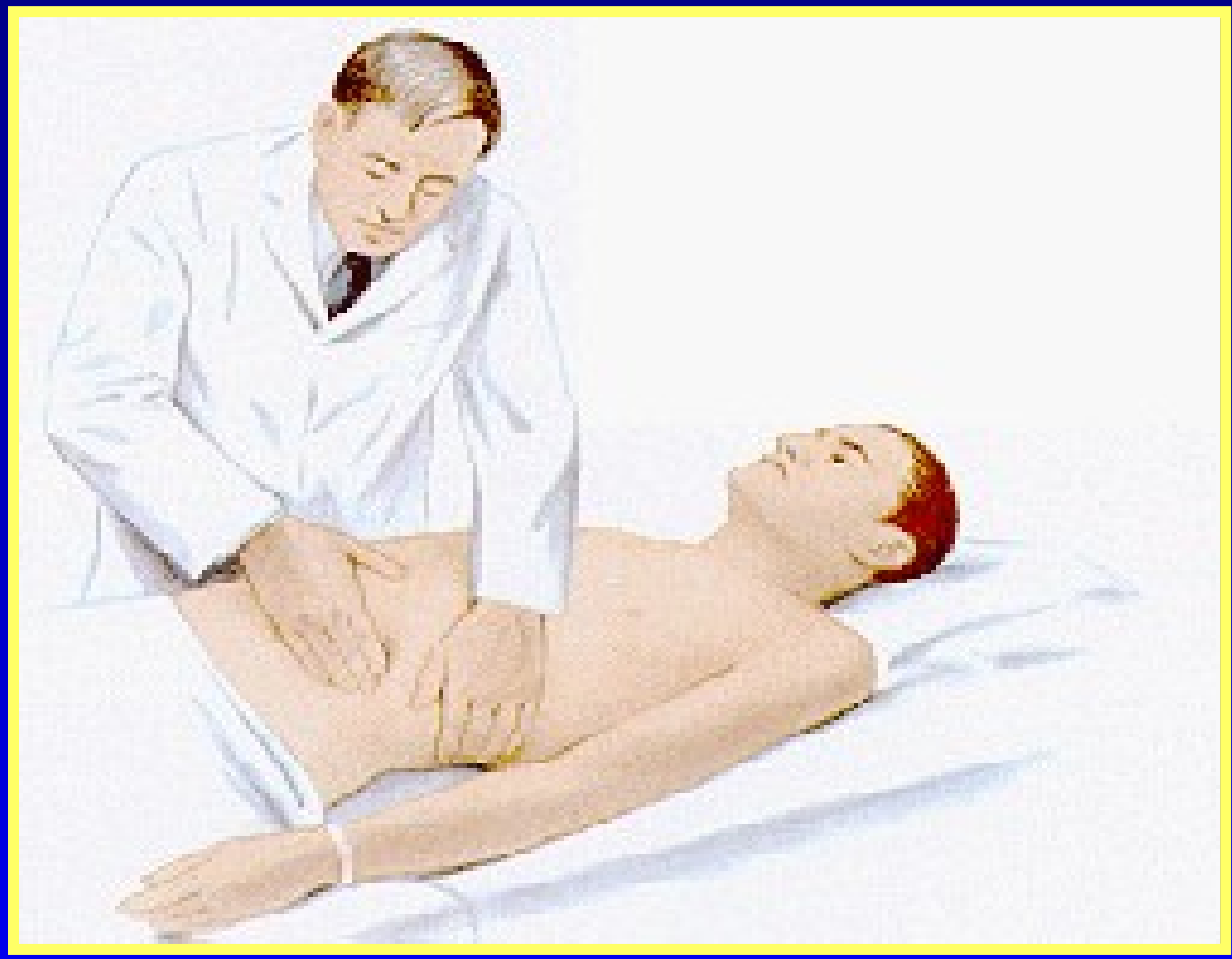
EUS scope

Non-visualized GB after 2hrs suggests cholecystitis

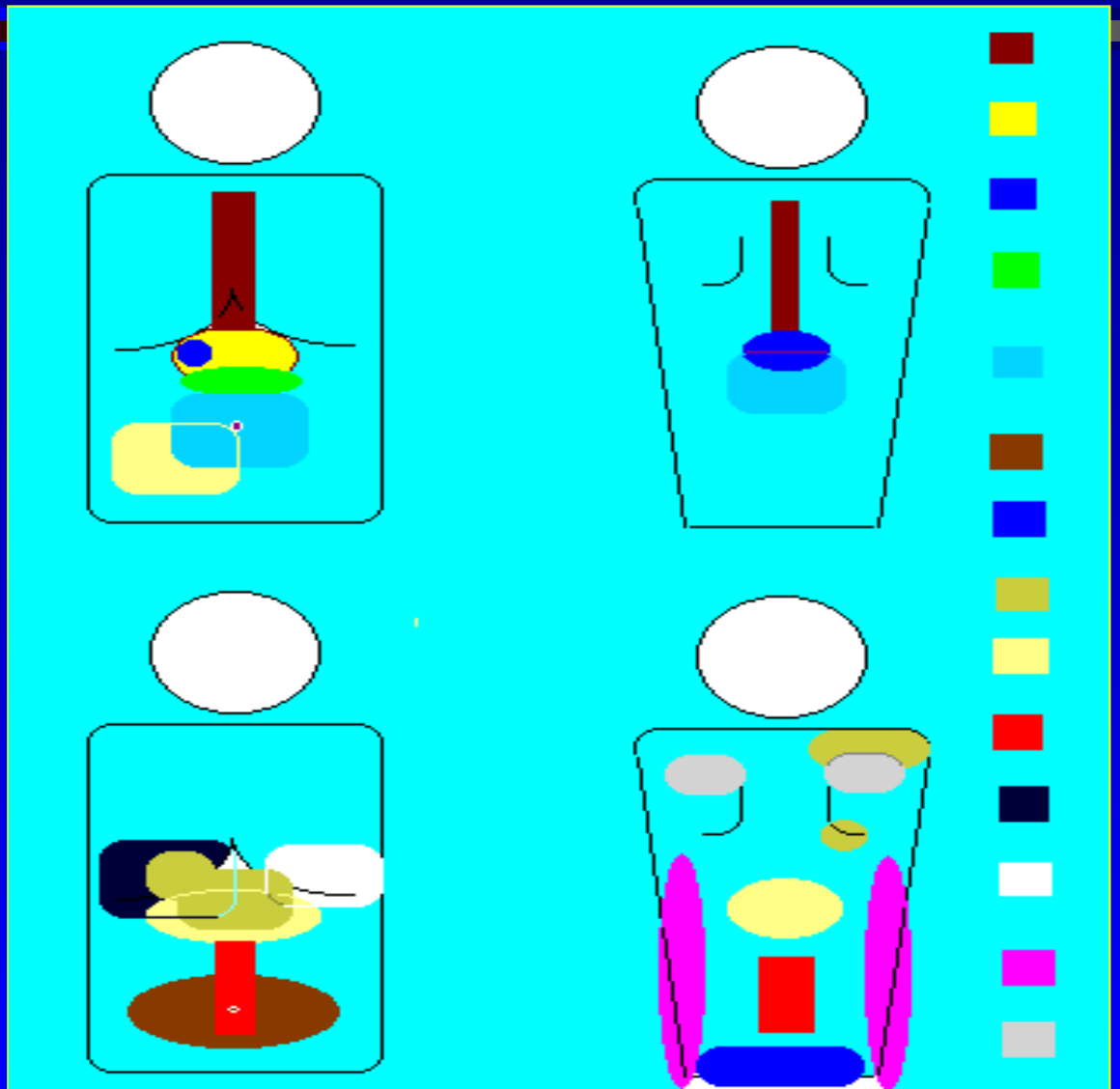
Magnetic resonance imaging

- Limited by:
  - availability
  - cost
  - image degradation with bowel and respiratory motion
  - patient restrictions
    - wt, pacers, metal implants etc.
- MCRP
  - offers a new diagnostic niche for MR technology





Pain location by organ system



- Esophagus
- Stomach
- Duodenal bulb
- 2nd/3rd duodenum
- Small bowel: jejunum to ileum
- Colon
- Rectum
- Gall bladder and CBD
- Pancreas
- Aorta
- Hepatic capsule
- Splenic capsule
- Kidneys
- Diaphragm

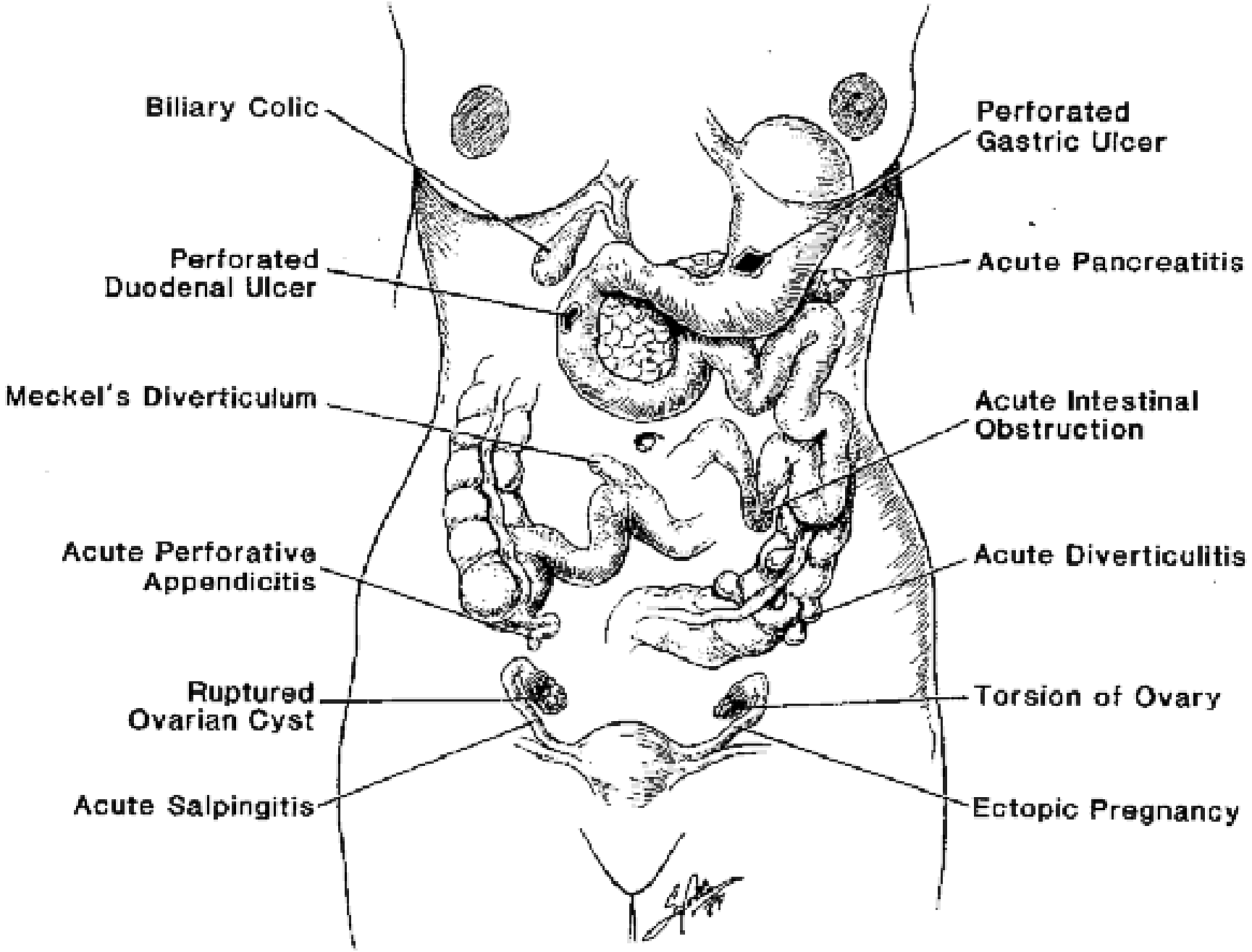


Figure 29–3. Common causes of abdominal pain.

“We diagnose what we look for and look for what we know”

Common Causes of Acute Abdominal Pain by Age Groups

- Infancy
  - GI
- Acute gastroenteritis
- Appendicitis
- Intussusception
- Volvulus
- Meckel's diverticula
  - Other
- Colic
- Trauma

- Adolescence/childhood
  - GI
  - Acute gastroenteritis
  - Appendicitis
  - Constipation
  - IBD
  - Peptic ulcer disease
  - Cholecystitis
  - Pancreatitis
  - Neoplasm

Common Causes of Acute Abdominal Pain by Age Groups

- Adolescence/childhood
- Other

- Functional abdominal pain
- Pelvic inflammatory disease
- Pregnancy
- Pyelonephritis
- Pneumonia
- Sickle cell crisis
- Trauma
- Diabetic ketoacidosis
- Heavy metal poisoning
- Renal stone

Common Causes of Acute Abdominal Pain by Age Groups

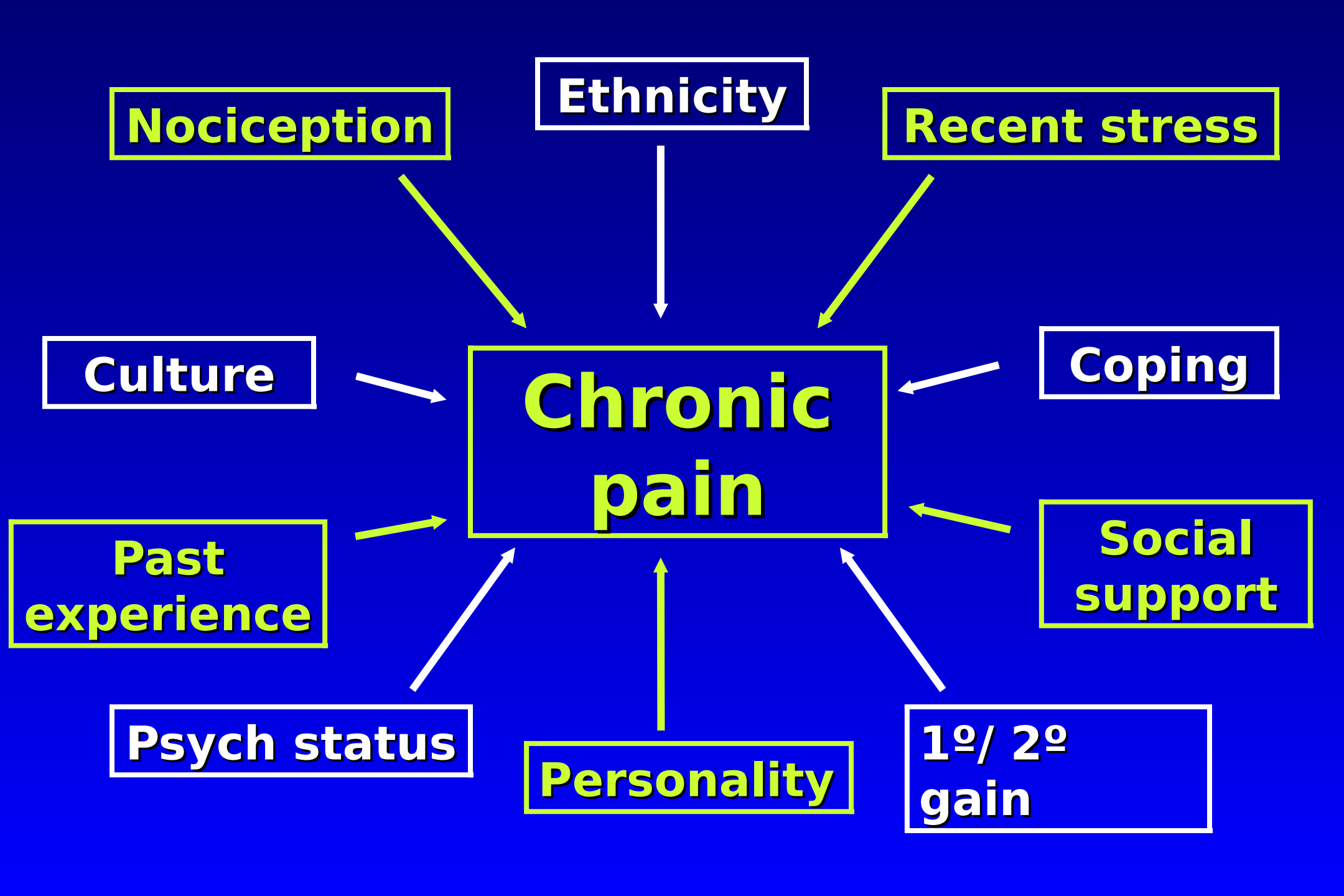
- Adult
  - GI
    - esophagitis
    - esophageal spasm
    - esophageal rupture
    - intestinal obstruction
      - hernia, intussusception, adhesions, volvulus
    - gallstones
    - ampullary stenosis
    - IBD
    - pancreatitis
    - IBS
    - non-ulcer dyspepsia
    - mesenteric ischemia
    - malignancy
    - abscess
    - chronic intractable abdominal pain
  - Cardiac
    - ischemia/MI
    - myocarditis/endocarditis
    - CHF

Common Causes of Acute Abdominal Pain by Age Groups

- Thoracic
  - pneumonitis
  - pleurodynia
  - PE/infarct
  - PTX
  - empyema
- Neurologic
  - radiculopathy
  - abdominal epilepsy
  - tabes dorsalis
- Metabolic
  - uremia
  - DM
  - porphyria
  - acute adrenal insufficiency
  - hyperPTH

Common Causes of Acute Abdominal Pain by Age Groups

- Toxins
  - hypersensitivity: insect or venom
  - lead poisoning
- Infections
  - zoster
  - osteomyelitis
  - typhoid
- Miscellaneous
  - muscle contusion, hematoma, tumor
  - narcotic withdrawal
  - FMF
  - psychiatric
  - depression
  - heat stroke
  - Mittelschmerz


Nociception
Ethnicity
Recent stress
Culture
Chronic pain
Coping
Past experience
Social support
Psych status
Personality
1º/ 2º gain

Functional GI disorders

- Functional abdominal pain syndrome
  - frequently recurring or continuous abdominal pain for at least 6mo
  - incomplete or no relation to physiologic events (e.g. eating, defecation or menses)
  - some loss of daily functioning
  - no evidence for organic disease to explain the pain & insufficient criteria for other functional GI disorders that would explain the pain

- Functional abdominal bloating
  - at least 3mo of the following:
  - symptoms of abdominal fullness, bloating or distension
  - unrelated to obvious maldigestion (lactose intol or xs consumption of poorly digestible but fermentable foods like sorbitol, beans or wheat bran) or other GI diseases producing similar symptoms
  - insufficient criteria for diagnosis of functional dyspepsia, IBS or other functional disorders

Rome criteria for Irritable bowel

Continuous or recurrent symptoms for at least 3 months

Abdominal pain or discomfort that is

One or more of these:

- ☐ Relieved with defecation
- ☐ Associated with a change in stool frequency
- ☐ Associated with a change in stool consistency

AND

Other symptoms on at least one fourth of occasions or days

Two or more of these:

- ☐ Altered stool frequency (>3 bowel movements per day or <3 bowel movements per week)
- ☐ Altered stool form (lumpy, hard stool or loose, watery stool)
- ☐ Altered stool passage (straining, urgency, or feeling of incomplete evacuation)
- ☐ Passage of mucus
- ☐ Bloating or feeling of abdominal distention

FIGURE 1: **Diagnostic criteria for irritable bowel syndrome,** sometimes known as the Rome criteria, have been developed by international teams of clinicians. To use this device, check off the symptoms that a patient experiences. One or more checks in the pain section and two or more in the second section indicate likely irritable bowel syndrome. A review of symptoms and a physical examination provide most of the information needed for diagnosis.

Sphincter of Oddi dysfunction

from Sherman *Am J Gastroenterol* 1991

- **Biliary type**
  - **Type I**
    - Typical biliary-type pain
    - AP/AS/AL ≥1.5-2x ULN
    - CBD dilated ≥ 12mm
    - Prolonged biliary drainage (> 45min) with patient supine
  - **Type II**
    - Typical biliary-type pain
    - 1 or 2 (+) findings from Type I
  - **Type III**
    - Typical biliary-type pain only

- **Pancreatic type**
  - **Type I**
    - Recurrent pancreatitis and/or typical pancreatic-type pain
    - Amy/lip ≥ 1.5-2x ULN
    - PD ≥ 6mm (head), ≥ 5 (body)
    - Prolonged drainage (>9min) with patient prone
  - **Type II**
    - Typical pancreatic-type pain
    - 1 or 2 (+) findings from Type I
  - **Type III**
    - Typical pancreatic pain only

Which patients with ? SOD to evaluate

from Sherman *Am J Gastroenterol* 1991

Type of pain	N	% abnormal SOM
Biliary I	**14**	**85.7**
II	69	55.1
III	32	28.1
Pancreatic I	**13**	**92.3**
II	98	58.2
III	57	35.1

** investigating for SOD with only a complaint of pain and no ** lab or radiographic abnormalities is rarely useful

Sexual and/or physical abuse influence functional GI syndromes

Psychosocial factors in Sphincter of Oddi dysfunction

	Controls	SOD	P value
Somatization	2.06	6.03	< 0.001
Hx of sexual abuse	0.22	0.97	< 0.001

From Lee et al. ACG 1994 Abstract

Recurrent abdominal pain and sexual abuse

	Controls	RAP	P value
Sexual abuse <14yo	23	64	< 0.001
Sexual abuse >14yo	13	48	

From Walker et al. *Am J Psychiatry* 1988

Psychiatric abnormalities are prevalent in chronic functional abdominal pain

Psychiatric factors in recurrent abdominal pain patients

	RAP	Controls	P value
Depression	64	17	< 0.001
Phobias	32	10	< 0.05
Dyspareunia	52	7	< 0.001
Decreased libido	28	7	< 0.05
Inhibited orgasm	16	3	< 0.05

From Walker et al. *Am J Psychiatry* 1988

Psychiatric factors in IBS patients and IBS non-patients

	IBS pt	IBS non-pt	Controls	P value
Hypochondriasis	33	5	0	< 0.001
Schizophrenia	25	17	4	< 0.001
Psychasthenia	23	9	2	< 0.001
Depression	31	7	4	< 0.001

From Drossman et al. *Gastroenterology* 1988

Don’t rule out a thoracic contribution to chronic upper abdominal pain

Jorgensen LS, Fossgreen J. Back pain and spinal pathology in patients with functional upper abdominal pain. *Scand J Gastroenterol* 1990; 25:1235-41

- 39 patients with chronic upper abdo pain in the absence of any organic intra-abdominal cause vs. 28 healthy controls
- 28/39 (72%) patients also had back pain vs. 5 (17%) control
  - 21/28 (75%) with back pain had exam findings pointing to a vertebral cause
  - most localized to lower T or TL region
    - shared innervation with upper abdominal tract

Abdominal wall pain

- The overlooked DDX
  - rectus sheath hematoma
  - rectus syndrome
  - idiopathic abdominal wall pain
  - abdominal endometriosis
  - ilioinguinal-iliohypogastric nerve entrapment
  - diabetic thoracic polyradiculopathy
  - thoracic disk herniation
  - painful rib syndrome
  - spinal cord tumor

Abdominal wall pain

- **Carnett's test*:** distinguish abdominal wall from intra-abdominal pain
  - palpate tender spot; apply pressure to elicit maximal tenderness
  - patient lifts head from bed or SLR to tense the abdomen
  - examiner again applies pressure
    - if abdominal wall:
      - pain will be intensified
    - if intra-abdominal:
      - tensed muscles will shield and pain is unchanged

* from Hershfield *J Clin Gastroenterol*

Antidepressant Dosing Guidelines

Antidepressant	GI Dosage (mg)	Antidepressant Range (mg/d)
Amitriptyline *(Elavil)*	10–150	50–300
Clomipramine *(Anafranil)*	25–100	25–250
Desipramine *(Norpramin)*	10–150	100–300
Doxepin *(Sinequan)*	10–200	75–300
Fluoxetine *(Prozac)*	10–20	20–80
Fluvoxamine *(Luvox)*	25–50	50–300
Imipramine *(Tofranil)*	10–150	75–300
Nefazodone *(Serzone)*	50–100	200–600
Paroxetine *(Paxil)*	10–20	20–50
Sertraline *(Zoloft)*	25–50	50–200
Trazodone *(Desyrel)*	25–50	150–600
Venlafaxine *(Effexor)*	10–20	75–375

Abdominal pain

TABLE I Historical indications of CPB

1 *Vasospasm*

Raynaud's phenomenon
Ischaemic ulceration
"Local shock"
Post-traumatic oedema
Angina pectoris
Hypertension
Acute arterial occlusions
Cerebrovascular accidents
Head injuries

2 *Aid to growth or healing*

Short limbs from poliomyelitis
Delayed union of fractures
Sudeck's atrophy
Charcot joints
Peptic ulceration

3 *Modification of*

(a) Gastrointestinal secretions
Pancreatitis, fibrocystic disease, peptic ulceration
(b) Intestinal mobility
Achalasia of cardia, pylorospasm, paralytic ileus
Hirschsprung's disease

4 *Miscellaneous*

Hyperhydrosis
Asthma
Herpes zoster
Subacromial bursitis
Migraine
Tabetic crises

5 *Pain*

Malignancy
Ischaemia
Causalgia
"Angina abdominis"
Pancreatitis
Phantom limb
"Sympathalgia"
"Cystalgia"

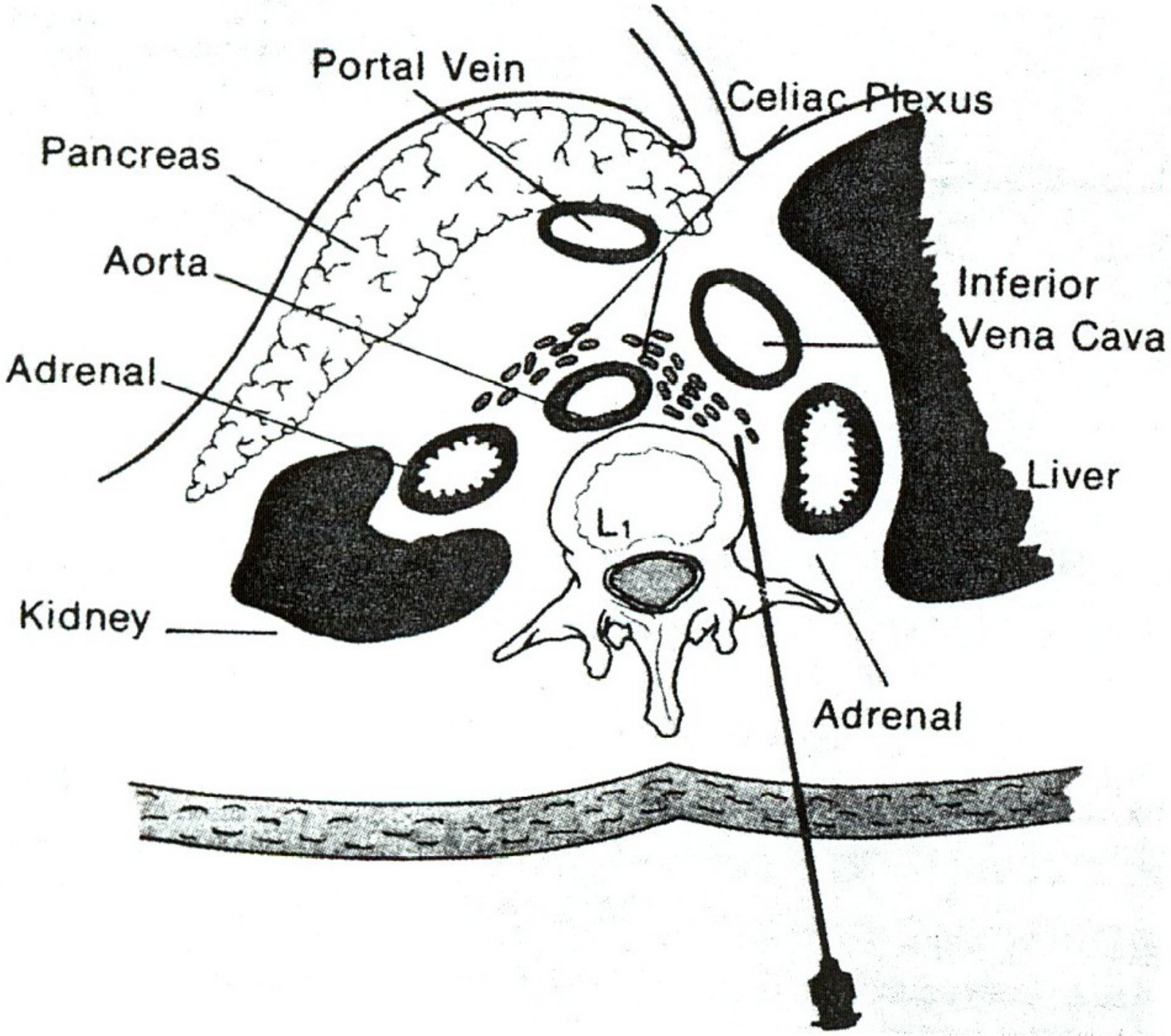

Portal Vein
Celiac Plexus
Pancreas
Aorta
Adrenal
Inferior
Vena Cava
Liver
L1
Kidney
Adrenal

TABLE III Comparison of results with NCPB

Percentage pain relief

Author	*Technique*	*Indications*	*Number*	*Good*	*Fair*	*Poor*
Bridenbaugh(1964)	Classic technique	Pancreatic cancer	25	88	8	4
		Other GI cancer	16	94	6	0
Black (I 973)	Classic technique	Pancreatic cancer	18	70	30	0
		Other GI cancer	35	70	17	13
		Chronic pancreatitis	*15*	64	4	32
Thompson(1977)	Classic technique	Abdominal cancer	97	78	16	6
		Chronic pancreatitis	3	0	0	100
Jones (1977)	Classic technique	Abdominal cancer	100	80	11	9
Hegedus (1979)	Classic technique	Pancreatic cancer	36	44	42	14
		Chronic pancreatitis	9	33	22	45
Moore (1979)	Classic technique	Abdominal cancer	168	83	11	6
Leung (1983)	Classic technique	Pancreatic cancer	13	85	*15*	0
		Chronic pancreatitis	23	52	26	22
Ischia (I 983)	Transaortic technique	Abdominal cancer	28	68	25	7
Owitz (1983)	Classic technique	Pancreatic cancer	80	85	-	-
		Chronic pancreatitis	50	70	-	
Brown (1989)	Classic technique	Pancreatic cancer	136	85	-	
		Other abd. cancer	66	73	-	-
Lieberman (1990)	Transaortic technique	Abdominal cancer	124	43	48	9
Ischia (1992)	Transaortic technique	Pancreatic cancer	20	55	30	15
	Classic technique	Pancreatic cancer	20	60	35	5
	Splanchnicectomy	Pancreatic cancer	21	71	24	*5*
All mean		Pancreatic cancer	369	**77**	**16**	**7**
		Abdominal cancer	634	**72**	**20**	**8**
		Chronic pancreatitis	100	**59**	**8**	**33**

Good: Complete pain relief or significant improvement of at least one month or until death.
Fair:. Improvement, complete pain relief of very short duration (<one week) or improvement necessitating narcotics for pain relief.
Poor No relief at all or very mild improvement.